



AN ENERGY OPPORTUNITY TO IGNITE THE PNG ECONOMY

DMA LONDON
APRIL 2018

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The National Executive Committee recently endorses policy to use of all Energy Forms



Solar & Battery



Hydro &
Wind



Coal



Gas &
Geothermal



Biomass

OBJECTIVES:

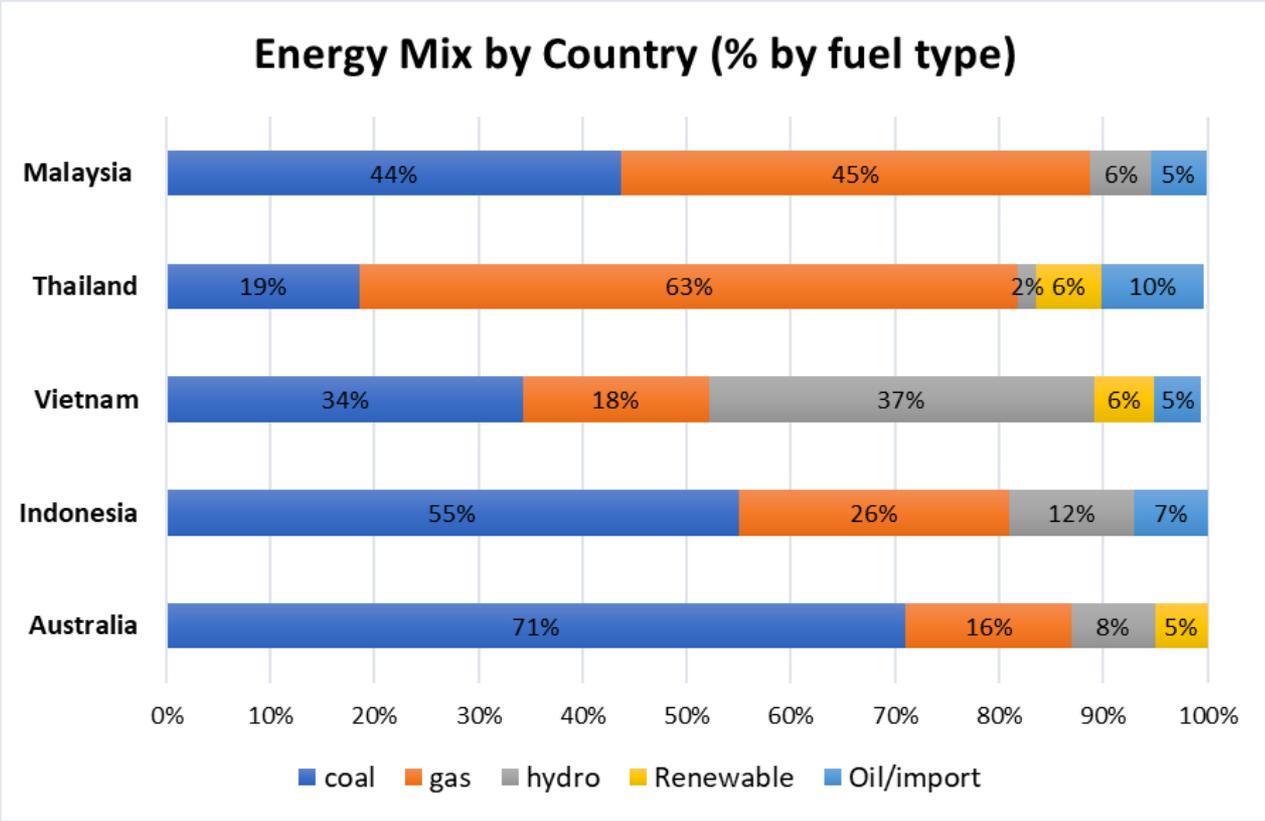
1  REDUCE PNG's COST OF ELECTRICITY

2  INCREASE RELIABILITY + STABILITY

3  DECOUPLE FUEL FOR ENERGY FROM INT MARKETS

DELIVERING CHEAP, STABLE ENERGY SECURITY = ECONOMIC GROWTH

South East Asia Developing Countries – Common thread Coal & Gas (no single silver bullet)



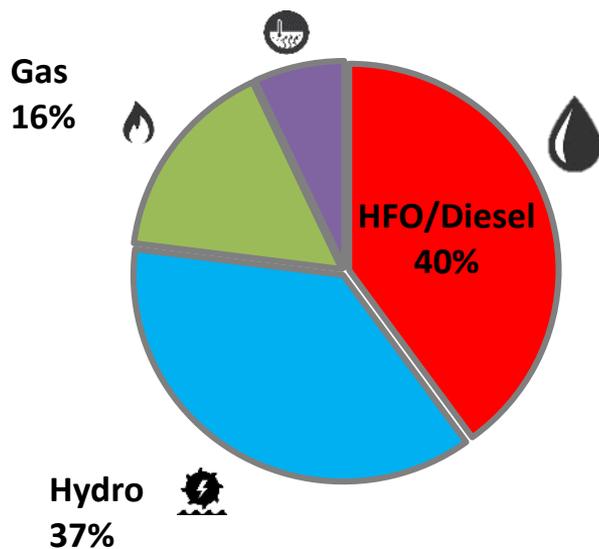
Indonesia produces 370 million tonnes of coal per annum. PNG Targeting 300,000 tonnes of coal per annum (50MW) comparatively being 0.08% of Indonesian annual production & sets new low price benchmark

Thermal Baseload with Renewables a Reality: Japan reliance on Coal today and in 2030 will remain at 23% of energy mix – Mr Yamada, METI Petroleum & Energy Conference, 2018

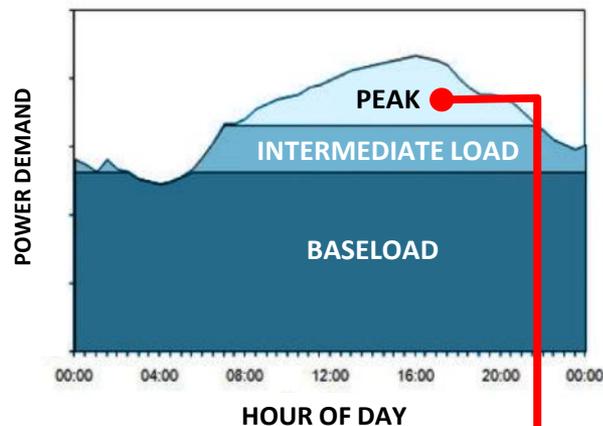
PNG'S CURRENT UNSUSTAINABLE RELIANCE ON IMPORTED LIQUID FUELS

PNG – a costly reliance on liquid fuel

- PNG's energy mix with 40% reliance on diesel is extremely high by world standards
- Heavy Fuel Oil & Diesel are linked to volatility of global energy prices – and drain FOREX reserves
- HFO/Diesel as a key component of baseload power is extremely inefficient, expensive and polluting
- High oil price good for Government & Corporates but high oil price is bad for PNG business where liquid fuel oil energy is big part of operating cost and cant compete internationally



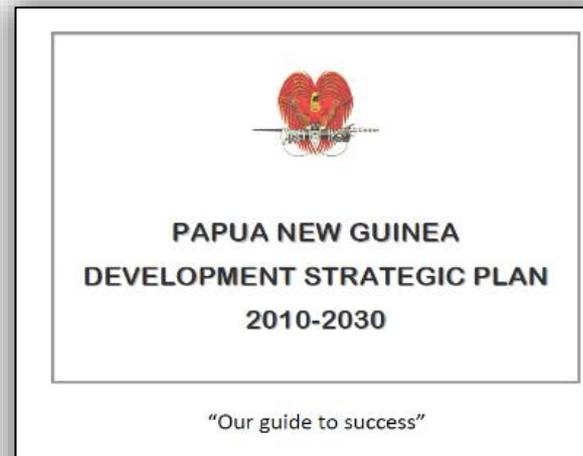
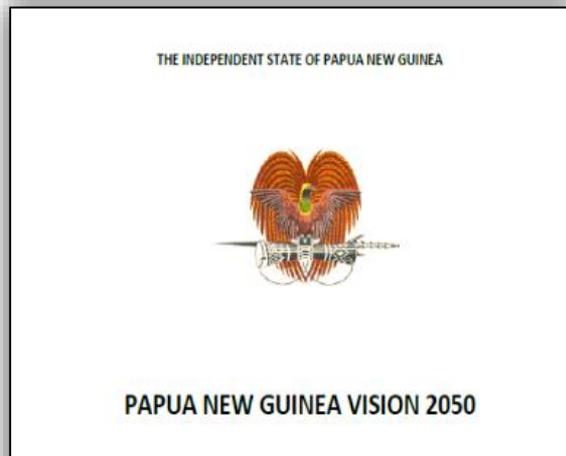
PNG'S ENERGY MIX – A HUGE OVER RELIANCE ON DIESEL



Diesel is not necessary for baseload power. If it is used it should be for peaking or back up only

PNG - strategic goals for 2030 and beyond

- **Vision 2050** - 5 of the 7 'strategic focus areas' - underpinned by a **well functioning electricity market**
- **2010–2030 Medium Term Development Plan** - goals underpinned by a need for reliable, efficient and affordable electricity sector



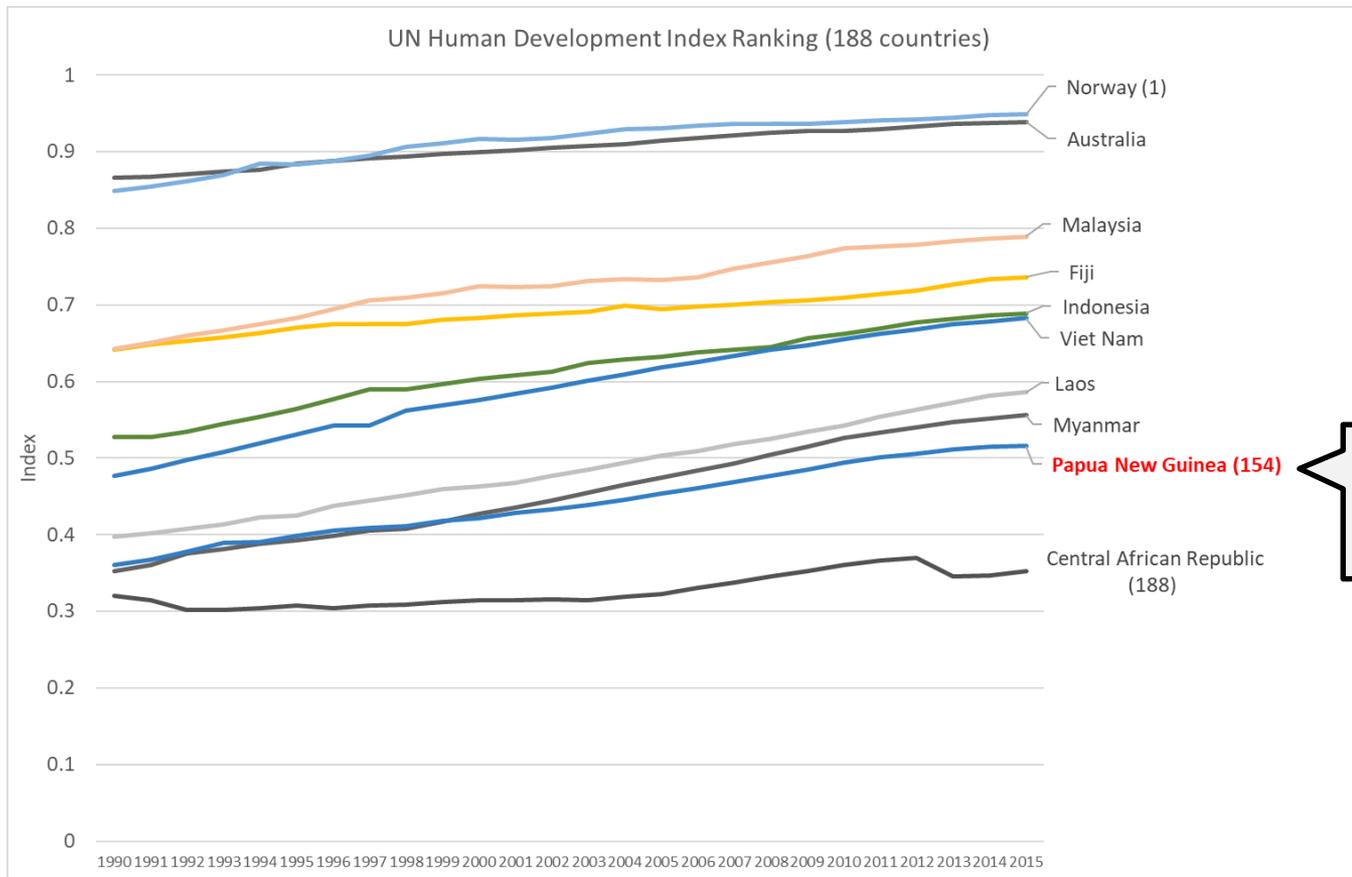
GOAL: 'A high quality of life for all Papua New Guineans'
VISION: 'PNG will be a prosperous middle income country by 2030'

Department of National Planning and Monitoring
Port Moresby
March 2010

Progress has been made but still some fundamental challenges around electricity provision

PNG – bottom quartile of UN Development Index

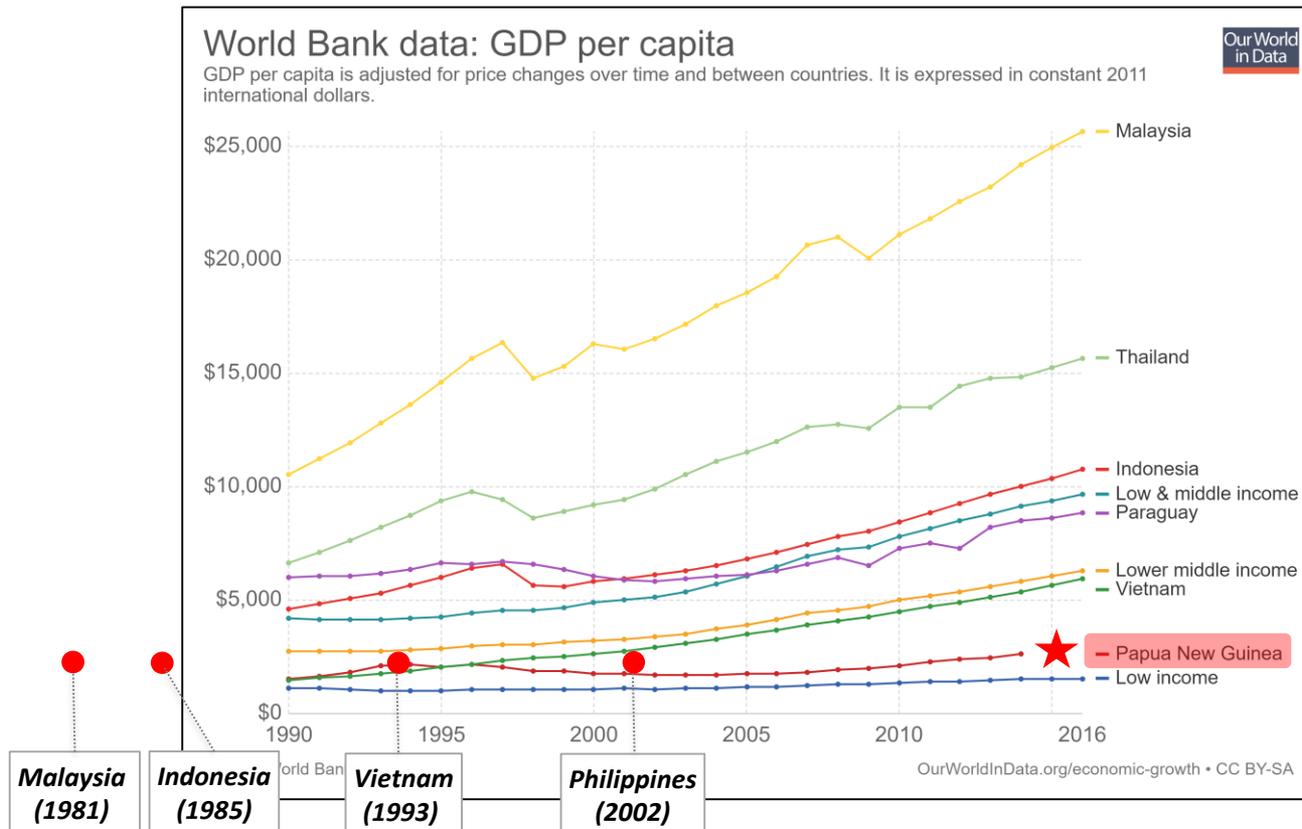
- PNG remains a low income country - firmly the bottom quartile of the world development index
- Time to look to the future and move PNG up the rankings – cheap electricity is the key



**“ODD COUNTRY
OUT IN ASIA
PACIFIC”**

PNG and its neighbours - GDP growth

- PNGs current per capita income is equivalent to Malaysia (1981), Vietnam (1993), Indonesia (1993) and Philippines (2002) – **why did PNG get left behind**
- **Forcing policy** of access to cheap power places PNG on a trajectory to becoming a low-middle income economy



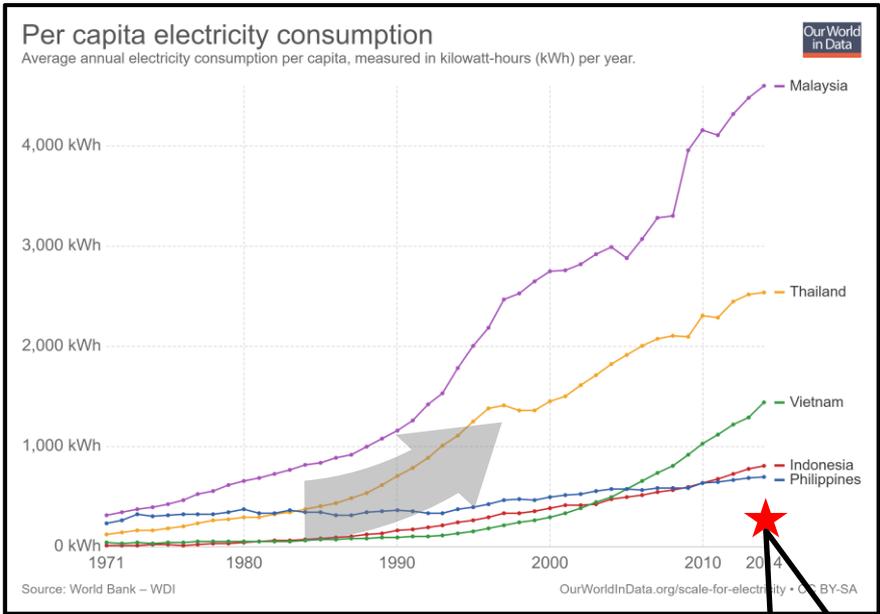
PNG's goal to be a 'middle income economy by 2030' – how? Gas usage has started

Coal underpinned South East Asia – Gas, Coal & Hydro will drive PNG Base Load with increasing renewables in the mix

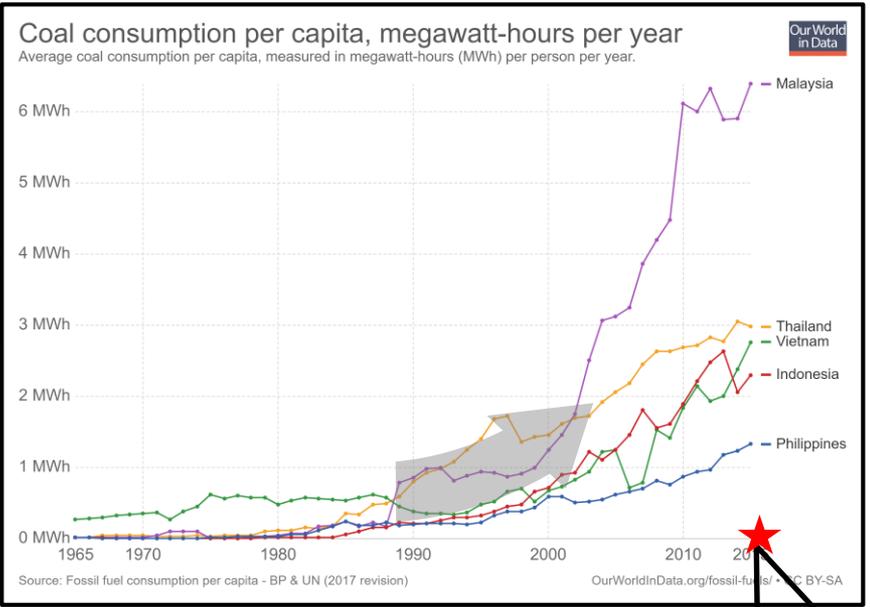


PNG imports huge amounts of heavy fuel oil for power generation – but it has its own Coal and Gas

- PNG’s energy consumption per capita is ~50% below World Bank lower middle income
- The rest of Asia has taken off since the 1990’s.....PNG has been left behind
- Direct link between GDP growth, electricity consumption and coal use but gas & hydro will also play a major part to electrify and industrialise PNG



DIRECT LINK

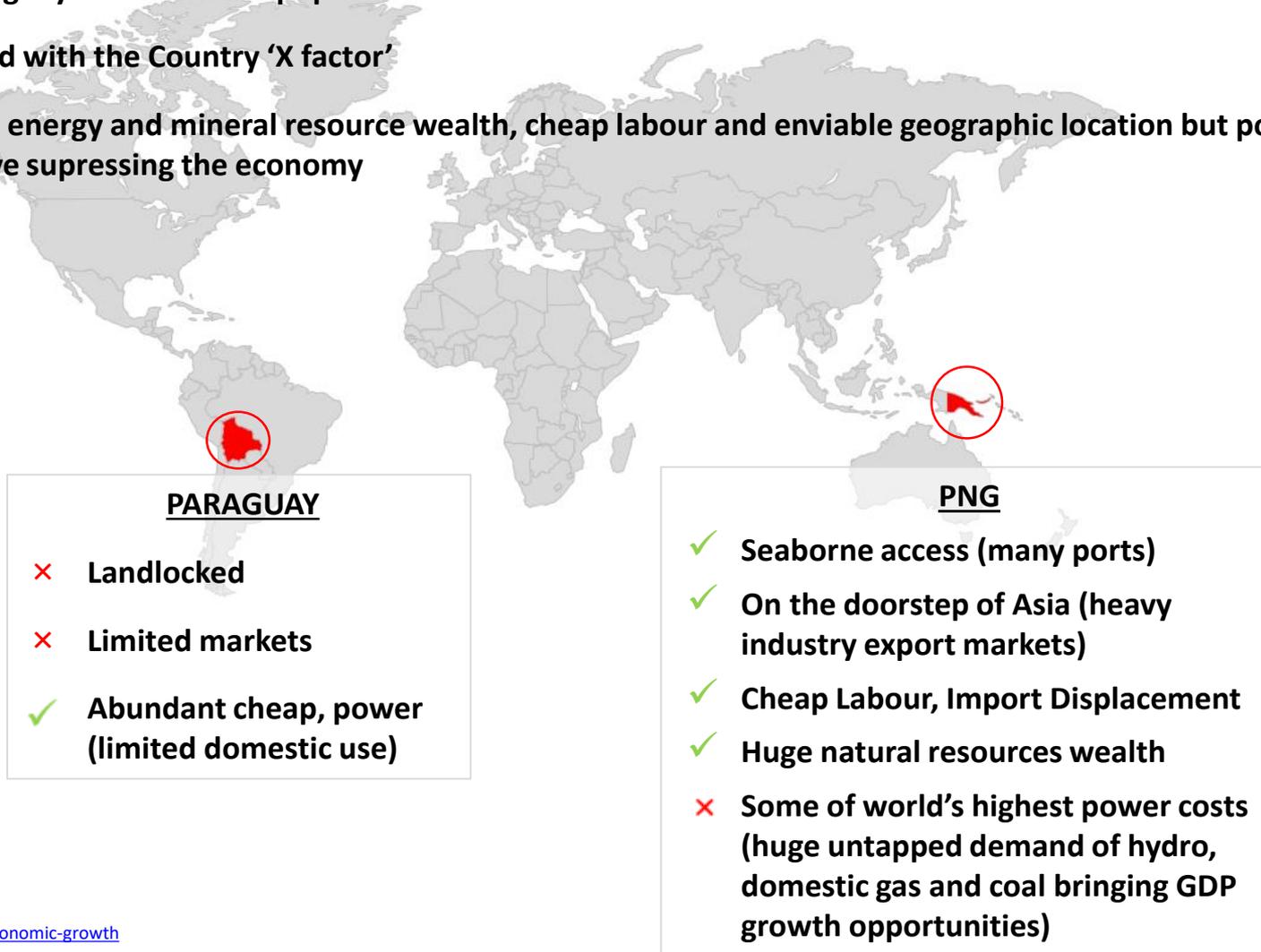


PAPUA NEW GUINEA (416 kWh per capita)

PAPUA NEW GUINEA (0 per capita)

PNG's X Factor

- PNG and Paraguay have a similar population and area
- PNG is blessed with the Country 'X factor'
- Huge natural, energy and mineral resource wealth, cheap labour and enviable geographic location but power is very expensive suppressing the economy



PNG – FACT vs. FICTION For Developing Countries with X Factor

- PNG's is not different to other neighbouring developing nations
- South East Asia Nations use Hydro, Fossil Fuel & Renewables with similar geographic dispersion challenges – **Policy is Key**
- Cheap, stable accessible power generates GDP growth not the other way round. Oneill Government supports value add, force all forms of cheap energy into the economy

FICTION:

GDP = GROWTH = ELECTRCITY DEMAND

~~NOT CONSISTENT HISTORIC DATA SET IN ASIA PACIFIC~~

PNG LEFT IN THE DARK

FACT:

CHEAP ACCESSIBLE ELECTRICTY (decoupled capped fuel price) + PNG 'X FACTOR' = GDP GROWTH

REGULATED ELECTRICITY SECTOR GOVT. POLICY ACCESS TO CHEAP CEMENT INTERNATIONALLY COMPETITIVE INDUSTRY



CORRECT

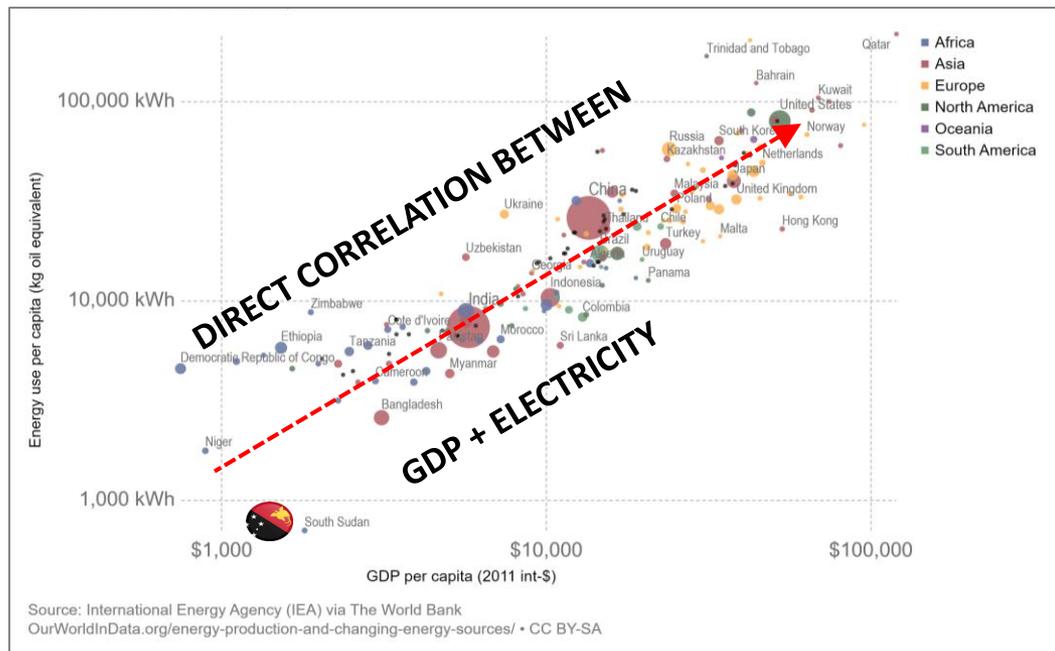
- Higher Income
- Better health
- Improved education
- Higher employment
- Improved living standards
- Following footprint of South East Asia

Proven case studies – Malaysia, Vietnam, Indonesia, Philippines etc....PNG is just as able as these nations

Electricity as a driver of growth around the world – what does it mean for PNG?

- History shows a strong correlation between electricity consumption and particularly GDP
- This correlation can be further enhanced by PNG’s ‘X factor’

Energy use per capita vs. GDP per capita



Increase in GDP per additional kWh of annual electricity consumption*:

 <p>AFRICA</p> <p>~US\$4.50</p>	 <p>SE ASIA</p> <p>~US\$2.50</p>
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 **PNG scenario:**

GDP US\$17BN / 3.4 BN kWh = ~US\$5

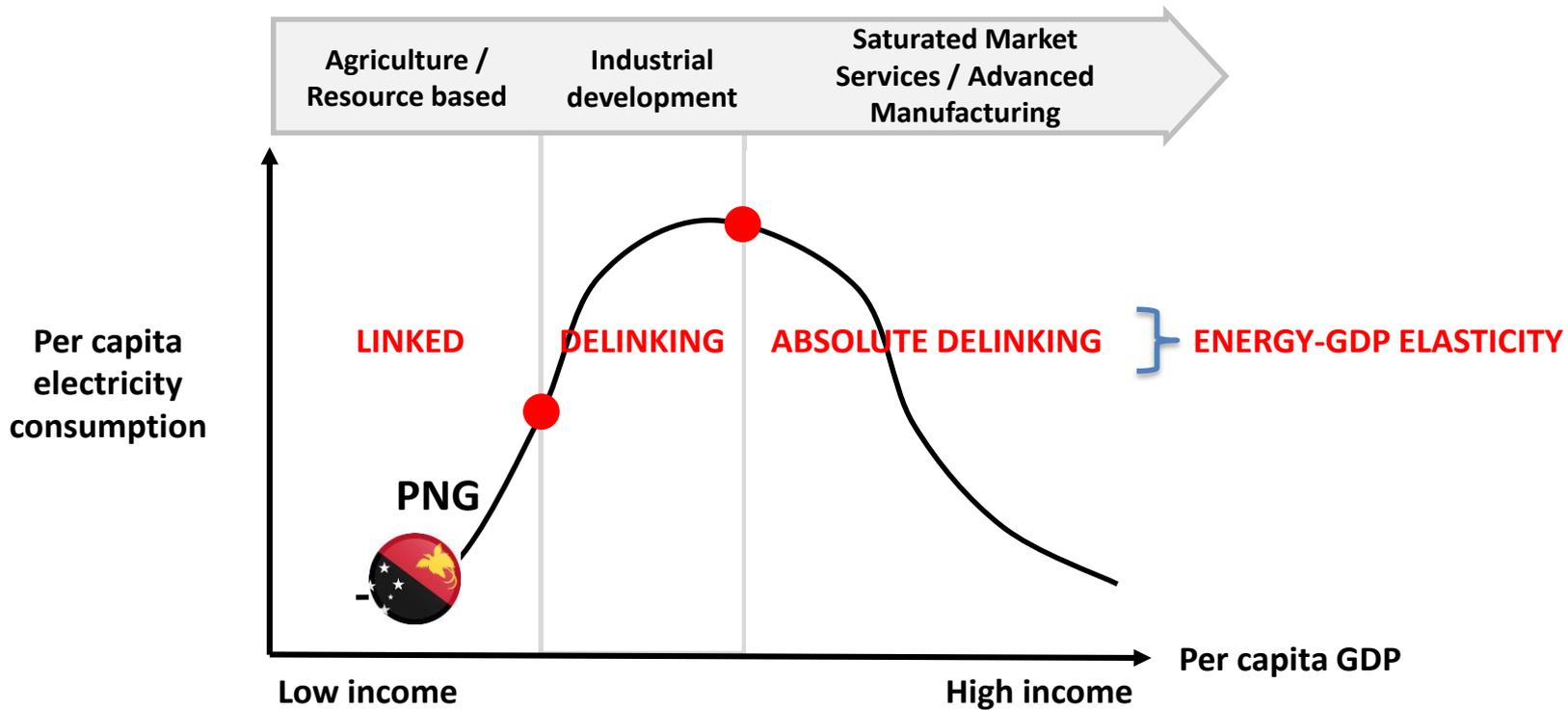
A CHEAP 50MW POWER STATION COULD INCREASE GDP BY US\$1.5 – 2.0 BN*

*Based on a 50MW plant producing ~400,000 kWh / year using range of USD3.50 GDP contribution ratio (mid point of SE Asia and Africa) and US\$5 (based on current)

Electricity Consumption/GDP Relationship - for how long?

The Lifecycle – PNG for decades to come has link between cheap energy consumption and GDP

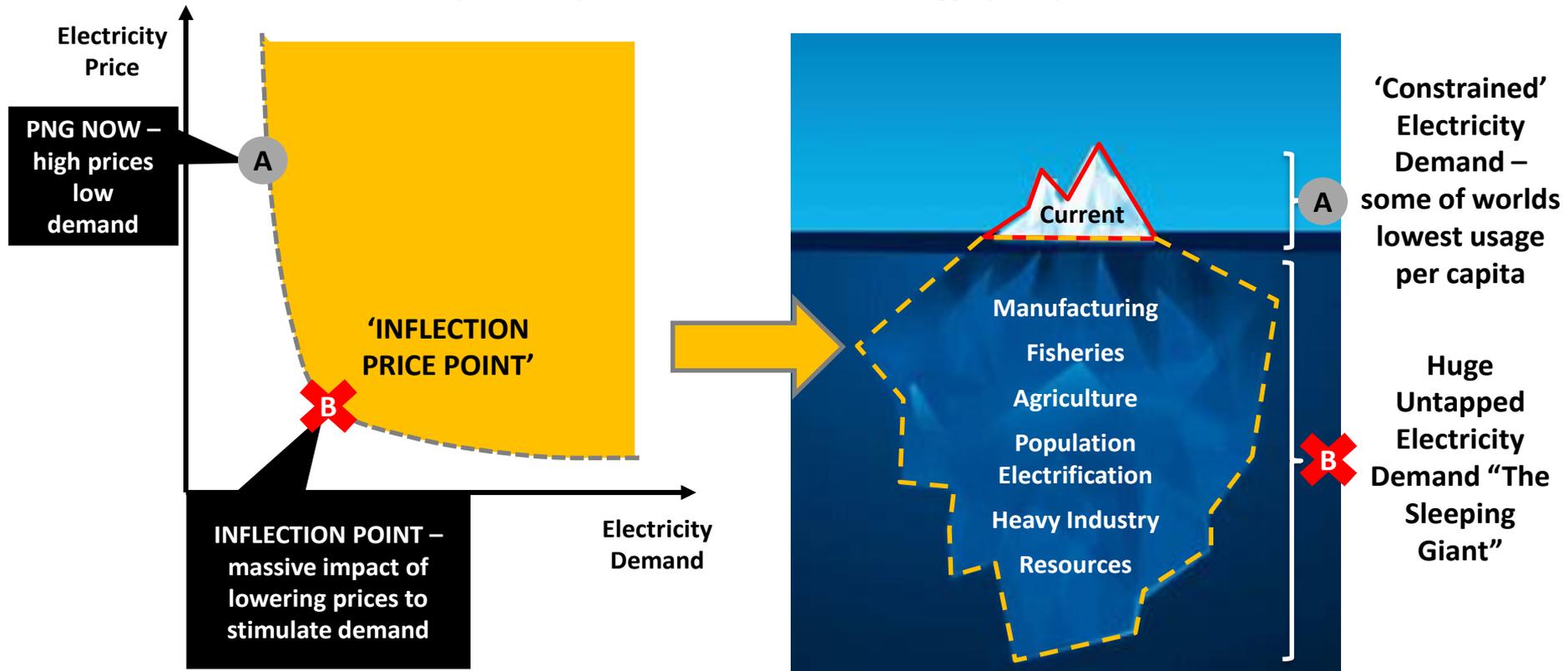
- PNG is a low income economy – link between energy consumption and GDP is strongest
- Demand elasticity is high – i.e. lower price = more than proportionate increase in demand



Policy reform must address PNG's need for cheap electricity to improve living standards

Current demand in PNG – the ‘Tip of the Iceberg’

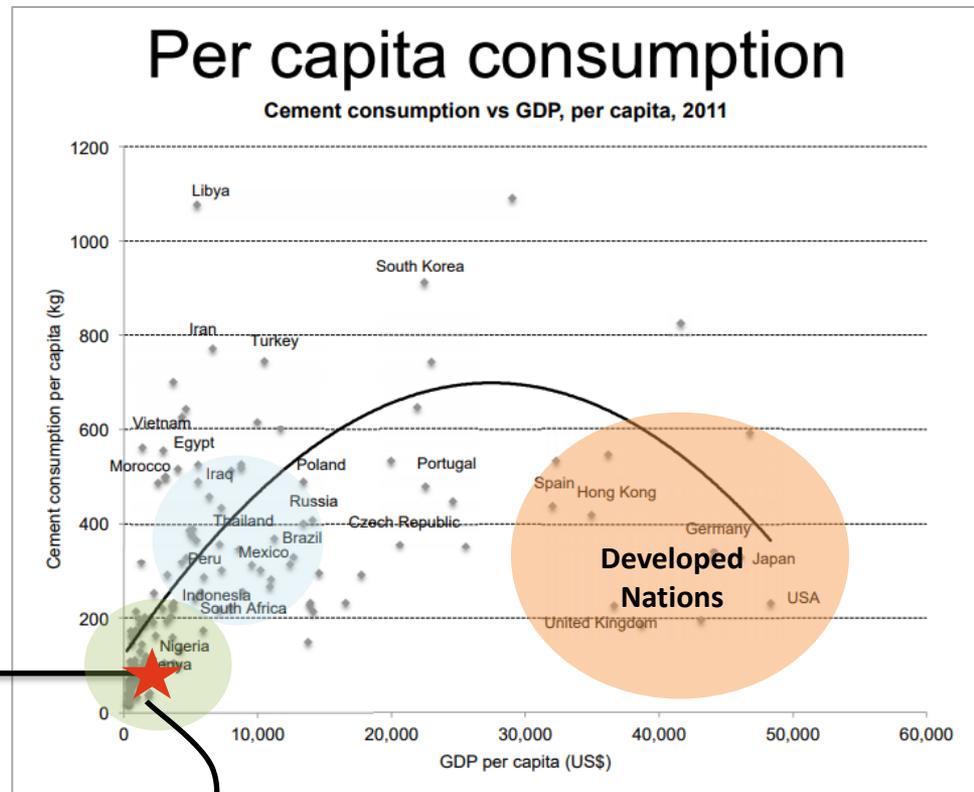
- Reducing electricity costs to unlock the sleeping giant of energy demand throughout the PNG economy
- PNG Prime Minister: *Think beyond the past embrace new technology of the future*



- PNG normalised on population per person would need 20,000 MW (33 times more vs today) to equal Australia electricity consumption per person – PNG closer proximity to the market and has cheaper labour

Is It Power + X Factor, or Is There More?

- Cement consumption – a key indicator of industrialisation (need cheap electricity, x factor, new industry = cement demand)
- Cement consumption per capita in PNG is in its infancy – PNG again at the bottom of the curve with **500% to 1000%** annual consumption increase potential to keep up with South East Asian peers



Strong Linkage between Cement Usage and GDP

- Developing nations
- Undeveloped nations

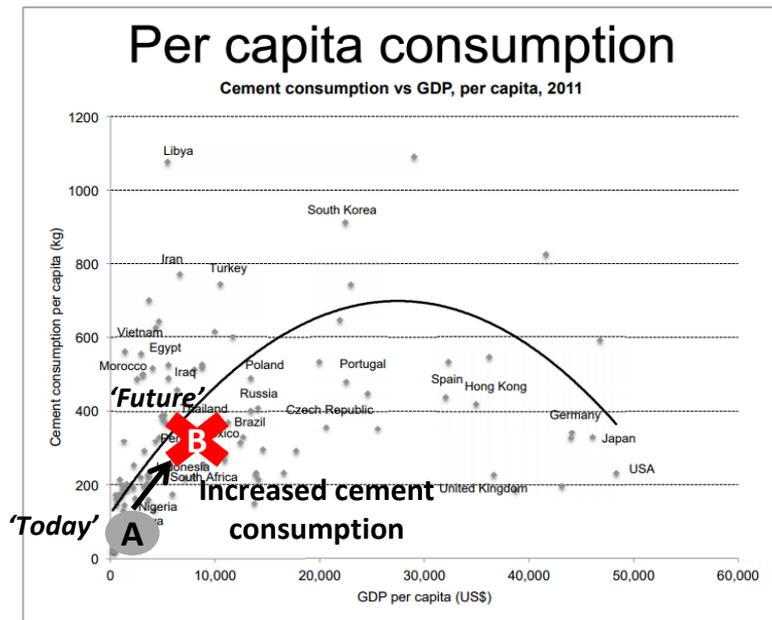
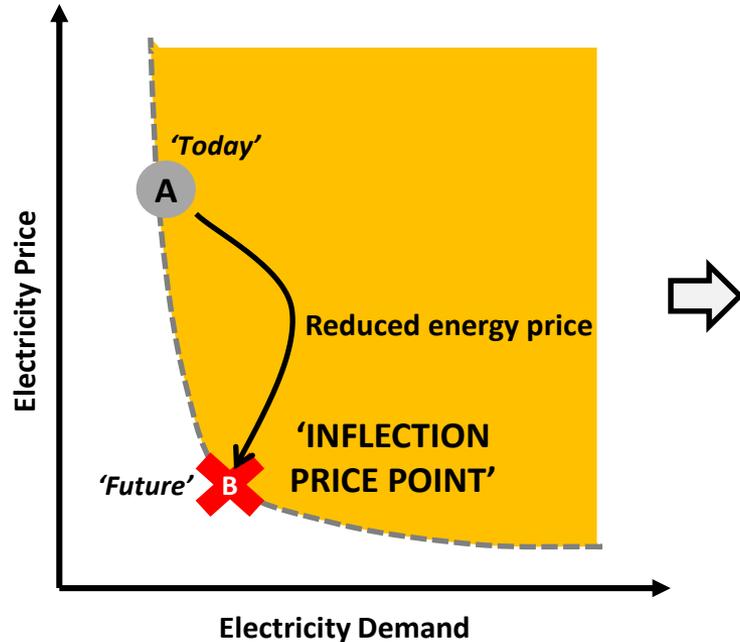
PAPUA NEW GUINEA
Cement consumption per capita: ~60 kg

HIGH ENERGY COSTS = LIMITED & NON-COMPETITIVE INDUSTRY = LOW CEMENT CONSUMPTION

PNG – Nation Building Blue Print to Drive Economic Diversification

➤ Reducing electricity costs to unlock demand throughout the economy

<p>ALL FORMS OF DOMESTIC CHEAP ENERGY</p>	+	<p>PNG 'X FACTOR' - LIME, SAND, AGGREGATES COASTAL LOCATION, PROXIMITY TO GAS IN POM</p>	+	<p>PNG DOMESTIC CHEAP MANUFACTURED CEMENT</p>	=	<p>NATION BUILDING INDUSTRIALISATION</p>
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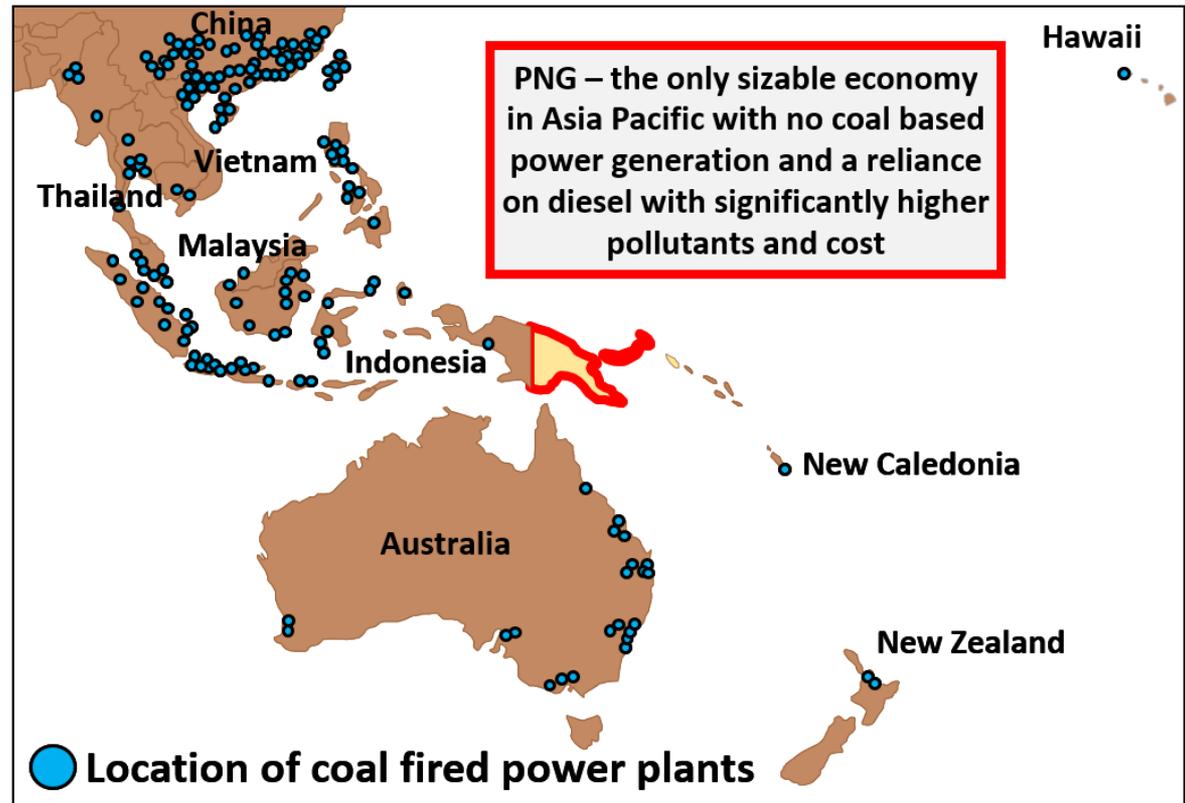
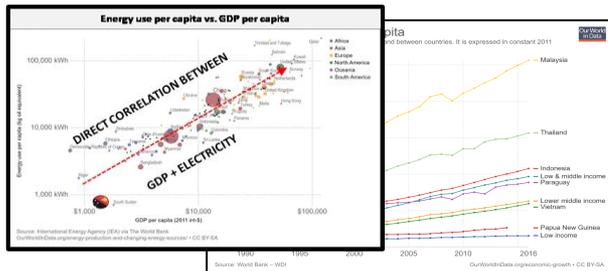
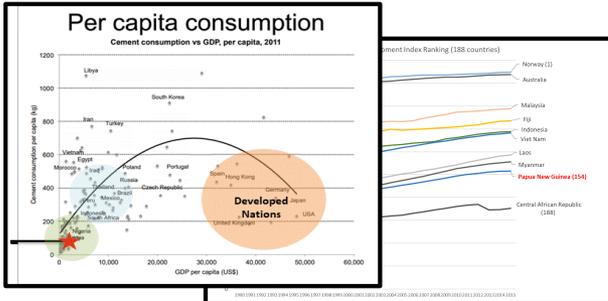
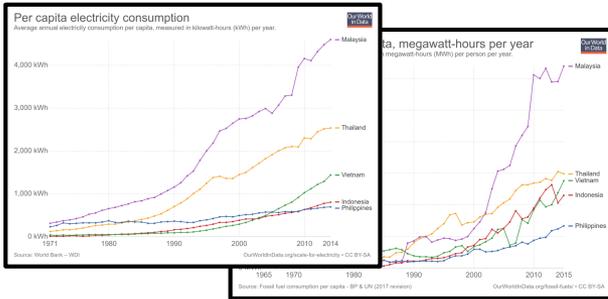
A diversified industry insulates against huge GDP fluctuations

- Time to invest in and diversify electricity generation in PNG – need diversified decoupled energy mix to protect economy
- Should not be simply waiting for the next resources ‘mega project’ to deliver GDP growth – PNG in the hands of international energy prices & mega project international developers



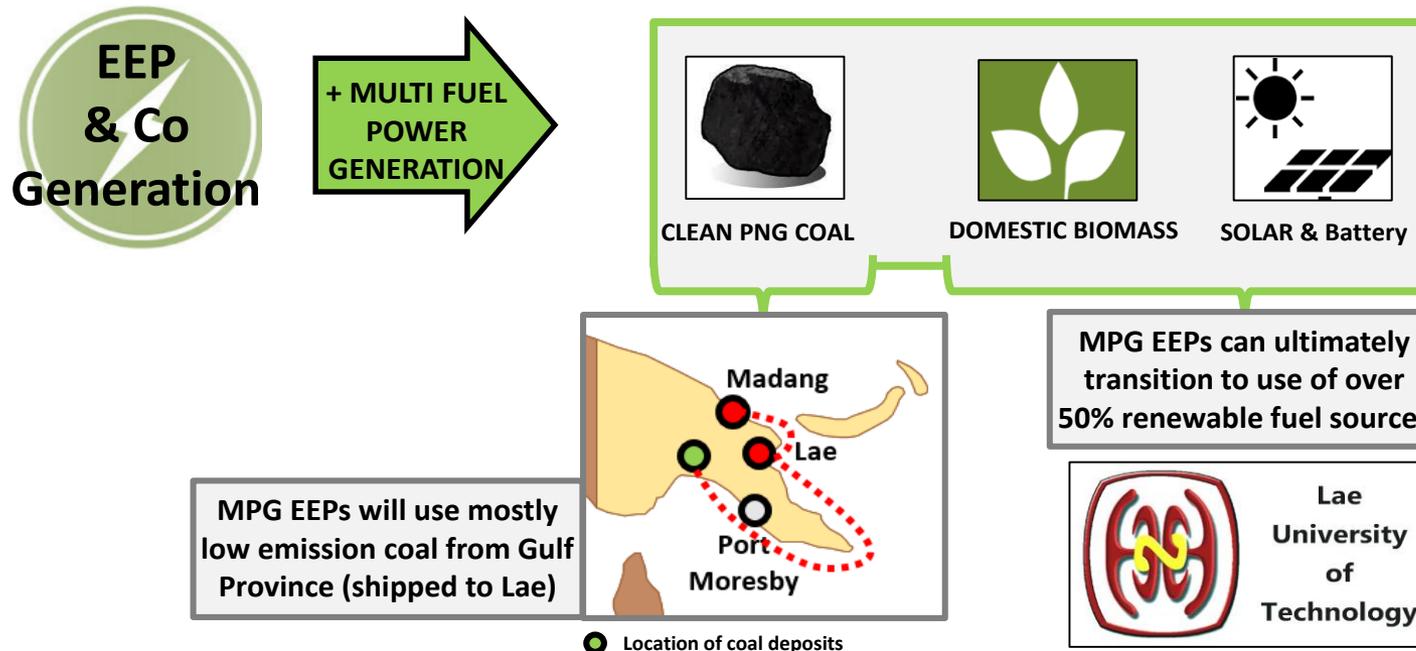
PNG vs Power Generation In Asia Pacific

- PNG - the only significant economy in Asia Pacific that doesn't take advantage of any coal for affordable and reliable baseload power but has recently discovered low ash, low sulphur high quality resources.
- Coal and Gas are plentiful in PNG – Gas beginning to be utilised that will displace imported liquid fuel



PNG'S Enviro Energy Parks - A Sustainable Power Solution For PNG – all big things first start small

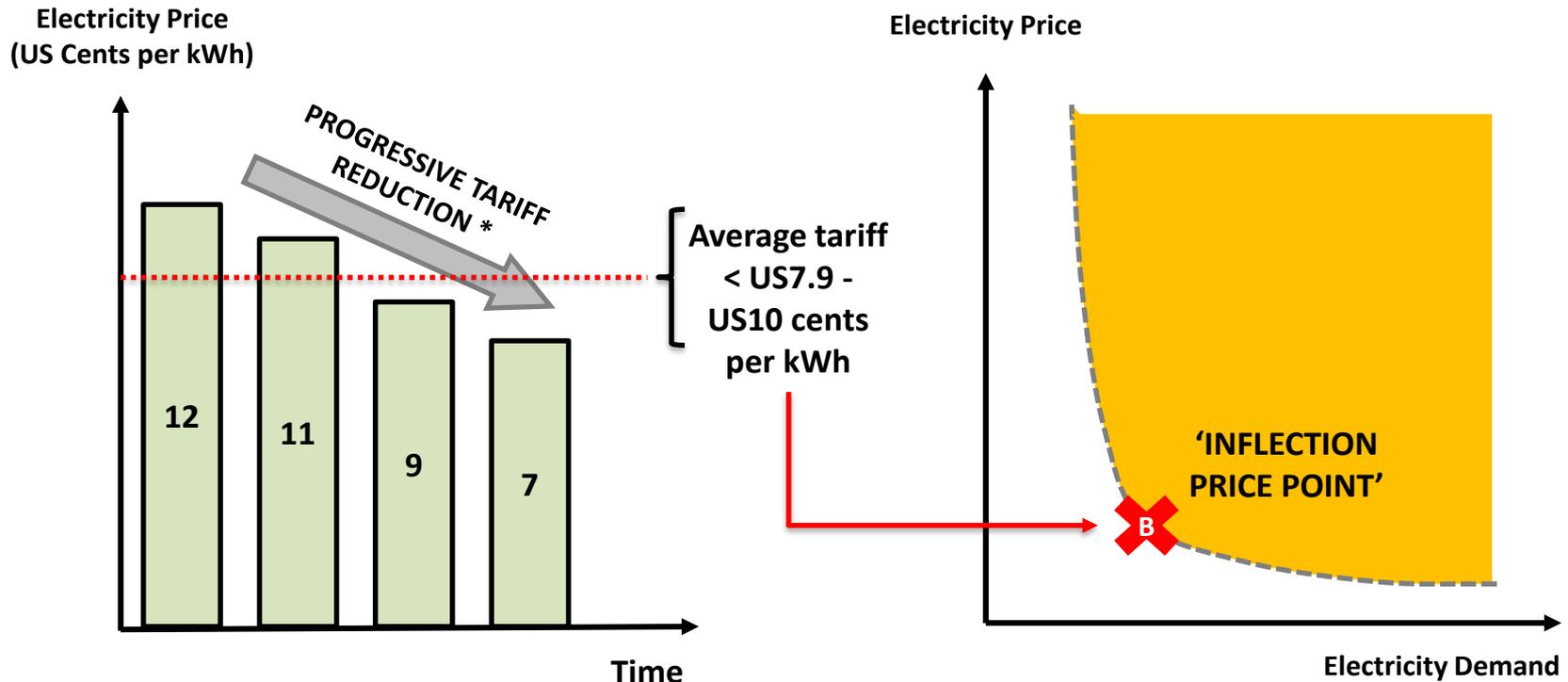
➤ **Mayur's Enviro Energy Parks (EEP)** - a transitional solution to PNG's energy supply challenges with gas and geothermal to be added



EXAMPLE: How Does PNG Get There?

A new price point for energy in PNG to be established

- New benchmark for electricity in PNG
- Reduced energy price unlocks demand at globally competitive inflection point
- Sets future competitive price point and decouples fuel price from international index volatility
- EEP 1st 50MW sub USD10 cents kWh average, 100MW loads have economies of scale USD7.9cents kWh



* Via economies of scale and post debt pay back etc

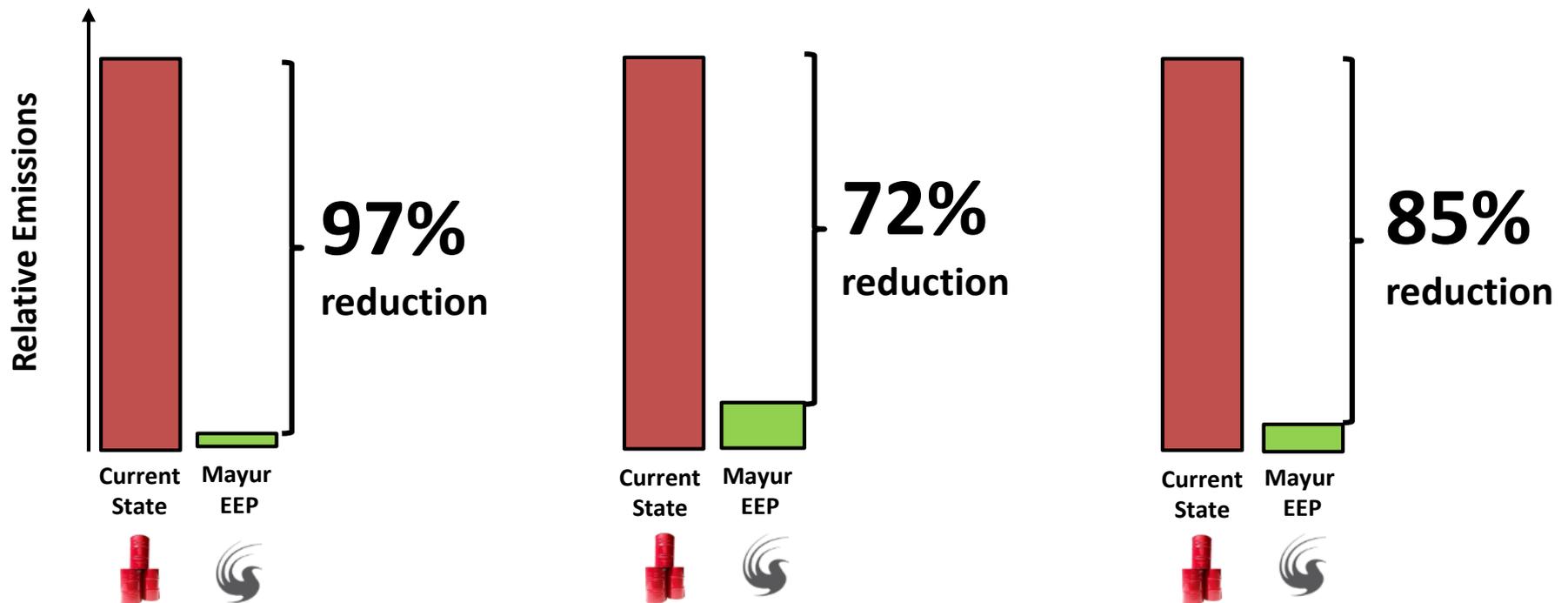
Massive Reduction In Atmospheric Toxins vs On and Off grid liquid fuel oil being used

- EEP will provide an immediate air improvement to urban populated environment
- Reductions independently reviewed against the current state
- OPPORTUNITY FOR GAS AND COAL EEP WITH RENEWABLE ENERGY AND CO-GENERATION OF WASTE HEAT

A Sulphur Di-oxide (Sox)

B Nitrogen Di-oxide (Nox)

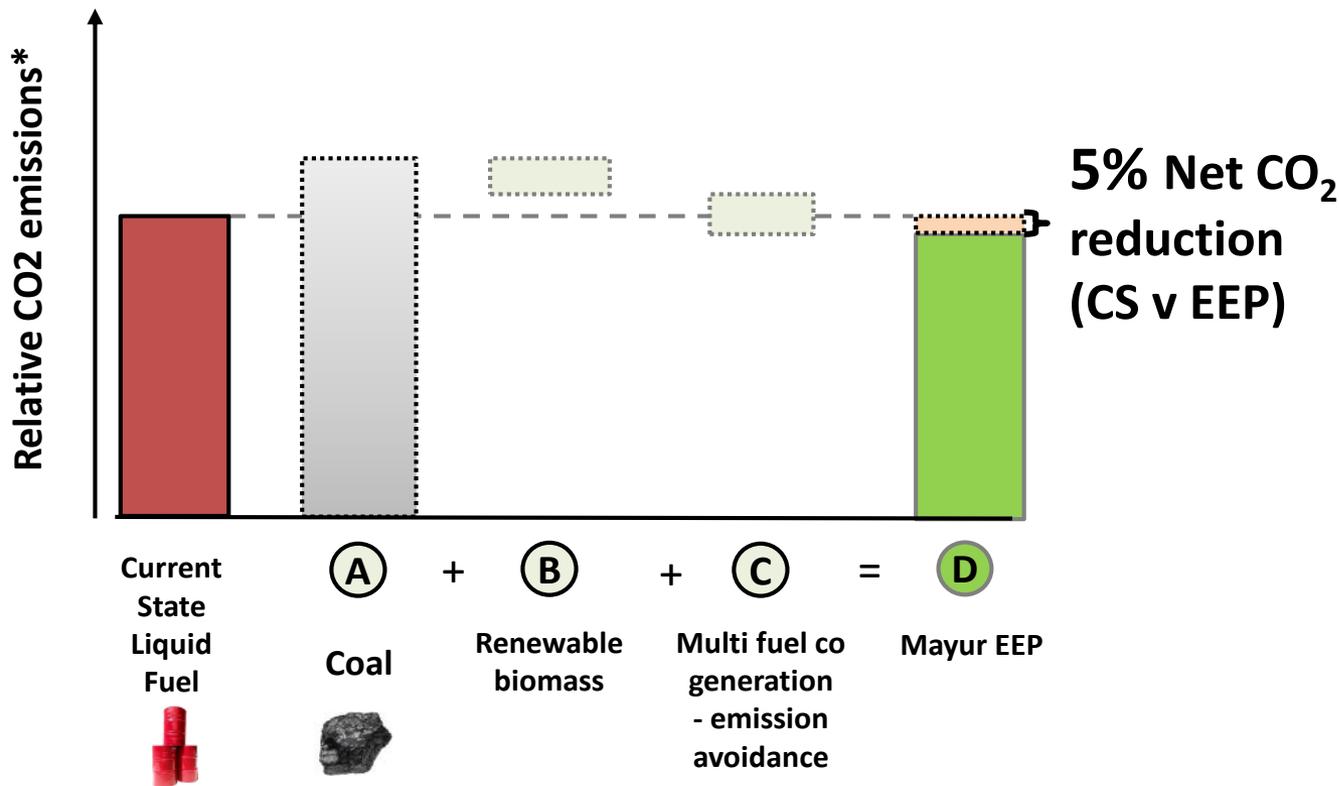
C Particulate Matter (PM)



EPP – MASSIVE REDUCTION IN ENERGY PRICE + IMPROVED ENVIRONMENTAL PERFORMANCE Vs Liquid Fuel

Decrease In Green House Gas Emissions (CO₂) while **reducing energy prices by 50% vs liquid fuel**

- Kyoto and COP21 is not anti coal, diesel or gas rather it is about reducing emissions
- EEP aligns with PNGs Intended Nationally Determined Contribution (INDC) & consistent with other South East Asia Signatories
- Opportunity for international investors to support multi fuel energy park rollout to electrify PNG - currently 600MW for 8 million people – PNG should see a **several fold increase** with its country x factor – policy is key



*chart only for illustrative purposes



THANK YOU

www.mayurresources.com